Attachment 1
Continuous Emissions Monitoring
Air Emissions Monitoring Protocol

QUALITY ASSURANCE/QUALITY CONTROL ACTIVITIES AND ACCEPTANCE CRITERIA

This section summarizes the performance-based Quality Assurance (QA) and Quality Control (QC) activities to be conducted on the CO and PM_{10} Continuous Emissions Monitoring (CEM) and related components (e.g., instrument response checks, calibrations, verifications, audit response checks) along with the corresponding frequency intervals, acceptance criteria, and control limits. Related considerations for CO reference gases and other test equipment are also addressed. Finally, periodic independent evaluations of monitoring program implementation and documentation, as well as other third-party regulatory (e.g., Mass DEP) audits are discussed.

CONTINUOUS EMISSIONS MONITORING CEM EQUIPMENT

The CEM equipment used to measure and/or record CO levels at these two types of locations, is described below.

VENTILATION BUILDINGS #1, #3, #4 AND #5 AND LONGITUDINALLY VENTILATED EXIT RAMPS

The CO CEM systems located at VBs #1, #3, #4 and #5 and longitudinal ventilated exit Ramps L-CS, CN-S, SA-CN, CS-SA, ST-SA/ST-CN, CS-P, DST-I93, DST-I-90 and F, consists of the following equipment:

- Fisher-Rosemount BINOS 100 Non-Dispersive Infrared Continuous CO Gas Analyzer with a range of 0 parts per million to 150 parts per million,
- Environics Series 6100 Multi-Gas Calibration System,
- Teledyne Advanced Pollution Instruments Model 701 Zero Air Supply,
- Environmental Systems Corporation Model 8816 System Controller/Data Logger,
- Scott Specialty Gases CO Calibration Gas - RATA Class with a nominal concentration of 1,350 parts per million.

VENTILATION BUILDINGS #6 AND #7

The CO CEM systems located at VBs #6 and #7 consists of the following equipment:

- Thermo Electron Model 48C Continuous Non-Dispersive Infrared Continuous CO Gas Analyzer with a range of 0 parts per million to 150 parts per million,
- Thermo Electron Model 146C Multi-Gas Calibration System,
- Thermo Electron Model 111 Zero Air Supply,
- Environmental Systems Corporation Model 8816 System Controller/Data Logger,
- Scott Specialty Gases CO Calibration Gas - RATA Class with a nominal concentration of 7, 500 parts per million.

The PM_{10} CEM monitoring system located at ventilation buildings 3, 5 and 7 and longitudinally ventilated exit Ramp CS-SA, consists of the following equipment:

- Thermo Electron (formally Rupprecht & Patashnick) TEOM Model 1400a continuous PM_{10} sampler with a range of 0 micrograms per cubic meter to 500 micrograms per cubic meter,
- Environmental Systems Corporation Model 8816 System Controller/Data Logger.

The CO and PM_{10} CEM systems located at ventilation buildings 1, 3, 4, 5, 6 and 7 and longitudinal ventilated exit Ramps L-CS, CN-S, SA-CN, CS-SA, ST-SA/ST-CN, CS-P, DST-I93, DST-I-90 and F, contain an Environmental Systems Corporation Model 8816 System Controller/Data Logger (ESC 8816 data logger). The ESC 8816 data logger is the Data Acquisition Handling System (DAHS) for each CEM location. The ESC 8816 controls the calibration routines for the CO analyzers and records all CO and PM_{10} concentrations on a hourly/daily basis. Compatible ESC E-DAS software is used to download accumulated hourly CO and PM_{10} concentrations each day from each CEM location, which is stored and used for developing CEM data reports.

ROUTINE AND PERIODIC QUALITY CONTROL CHECKS

The QC function encompasses the routine day-to-day and periodic operational activities necessary for assessing, maintaining and improving CO and PM_{10} measurement data quality and recovery, and the instruments and systems necessary to produce that information. These activities include, among other things:

- CO analyzer zero and span response checks, multi-point calibrations, and checks of sampling system integrity,
- Gas dilution calibrator system verification checks and multi-point calibrations of the zero (dilution) air and calibration gas mass flow controllers (MFCs), and
- Verification of PM_{10} monitoring system MFC outputs, verification and calibration of MFC software and related hardware components, and verification of mass transducer system calibration.

Table A-1 details the scope of these performance-based QC checks for each type of instrument, the corresponding acceptance criteria, and the corrective actions to be taken if the results of a check indicate that the system or component is out of tolerance.

Equally important elements of the overall QC function include: data review; measurement site and equipment inspections; preventive maintenance; troubleshooting and corrective action processes; inventory control for spare parts and consumable items; and the generation and maintenance of related documentation.

One of the primary purposes of conducting daily zero and span response checks is to substantiate the validity of CO measurement data since the last such check or a multi-point calibration (if one has occurred in the intervening time period). The control limits for data validation, as shown in Table A-1, are a zero response greater than 1 part per million (ppm), or for the span response a difference of greater than 10 percent between the analyzer response and the reference span gas concentration. The span control limit represents twice the allowable performance specification (i.e., a difference greater than 5 percent) that applies during initial certification of the CO analyzer.

TABLE A-1: ROUTINE AND PERIODIC QC CHECKS, ACCEPTANCE CRITERIA, AND CONTROL LIMITS (PAGE 1 OF 2)

Instrument	QC Check	Frequency	Acceptance Criteria / Control Limits
CO Analyzers	Zero/Span Response	Daily	• ≤ 1 ppm. Allowable difference between analyzer response and zero air reference gas. Data valid. Re-calibration required if out of tolerance. • ≤ 5.0%. Allowable percent difference (relative to reference span gas concentration) between analyzer response and reference span gas concentration. Data valid. Re-calibration required. • ≤ 10%. Control limit on percent difference (relative to reference span gas concentration) between analyzer response and reference span gas concentration. Data invalid back to last acceptable zero/span check; continuing until successful completion of multi-point calibration.
	Leak Test	Quarterly	• No leaks detected at tube fittings or other critical locations in flow system (e.g., calibration gas delivery system, zero air generator, dilution calibrator).
	System Bias (Sample Line Integrity) Check	Quarterly	• ≤ 5.0%. Allowable percent difference between system response and analyzer response relative to analyzer response. If out of tolerance, check for leaks, blockages; repeat check.
	Multi-Point Calibration	Quarterly	• ≤ 1 ppm. Allowable difference between analyzer response and zero air reference gas. Applies to zero test point only. • ≤ 10.0%. Allowable percent difference between analyzer response and high-level reference gas concentration. Applies to high-level test point only. • ≤ 5.0%. Allowable average of percent differences between remaining three non-zero calibration test points (i.e., low-low, low and mid-level) and corresponding reference gas concentrations. • Re-calibrate if out of tolerance. Data invalid back to last acceptable zero/span check; continuing until successful completion of multi-point calibration.
Gas Dilution Calibrators	Mass Flow Controller (MFC) Accuracy	Annual	<u>Environics Model 6100 Multi-Gas Calibrator</u>: • + 0.005 to +0.015VDC. Confirm that zero response output voltage to zero airflow is within tolerance. If not, adjust. • ± 1.0%. Actual set point flow. If not, contact vendor or consult manual for troubleshooting. • ± 3.0%. Post-calibration verification. Allowable percent difference between three non-zero set points (i.e., 10%, 45% and 95%) and corresponding reference flow rates. If out of tolerance, check reference flow entries from verification check and calibration. Re-calibrate if necessary. • ± 5.0%. Two Point Verification. Re-certification of the Mass Flow Controller will be considered. <u>Thermo Electron Model 146C Dynamic Gas Calibrator</u>: • + 0.245 to +0.255VDC. Confirm that output voltage for 5% of full scale flow set point (relative to +5V full scale output) is within tolerance. If not, contact vendor before adjustment and calibration. • ± 3.0%. Post-calibration verification. Allowable percent difference between two non-zero set points (i.e., 30% and 85%) and corresponding reference flow rates. If out of tolerance, check reference flow entries from verification check and calibration. Re-calibrate if necessary. • ± 5.0%. Two Point Verification. Re-certification of the Mass Flow Controller will be considered.

TABLE A-1: ROUTINE AND PERIODIC QC CHECKS, ACCEPTANCE CRITERIA, AND CONTROL LIMITS (PAGE 2 OF 2)

Instrument	QC Check	Frequency	Acceptance Criteria / Control Limits
PM_{10} Monitors	Leak Test	Quarterly	• < 0.15 liter/min. Confirm that Main Flow and Total Flow (Main + Auxiliary) readings are within tolerance. If out of tolerance, check tube fittings, other critical locations in flow system.
	Ambient Air Temperature Verification/Calibration	Annual	• ± 2 °C. Allowable difference between ambient (display) and reference temperature values. Re-calibrate sensor by adjusting analog input channel potentiometer until ambient (display) matches reference temperature value (in degrees C) if out of tolerance.
	Ambient Pressure Verification/Calibration	Annual	• ± 10 mm Hg. Allowable difference between ambient (display) and reference station pressure values. Re-calibrate sensor by adjusting analog input channel potentiometer until ambient (display) matches reference temperature value (in degrees C) if out of tolerance.
	Flow Audit	Quarterly	• ± 1.0 liter/min. Allowable difference between Total Flow (Main + Auxiliary) set point and reference flow reading. If out of tolerance, re-calibrate Flow Controller Software, Analog I/O Board, and/or Flow Controller Hardware, as necessary. [a, b] • ± 0.2 liter/min. Allowable difference between Main Flow set point and reference flow reading. If out of tolerance, re-calibrate Flow Controller Software, Analog I/O Board, and/or Flow Controller Hardware, as necessary. [a, b]
	Mass Transducer Calibration Verification	Annual	• ± 2.5%. Allowable percent difference between indicated and original calibration constants. Consult manufacturer if out of range.
	Flow Controller Software Calibration	Semi-Annual [a]	• ± 10.0%. Allowable percent difference between Main or Auxiliary Flow set point and corresponding reference flow rate. If out of tolerance, Flow Controller Hardware Calibration, preceded by Analog I/O Board Calibration, required.
	Analog I/O Board Calibration	Annual [b]	• Test analog output (D/A) channels at 90% of full scale (0-2 or 0-10 VDC, as appropriate). Then, test analog input (A/D) channels at 90% of full scale (± 2 VDC or ± 10 VDC, as appropriate). Adjust channel output/input as needed.
	Flow Controller Hardware Calibration	Annual [b]	• Check and adjust span potentiometer to 10.000 VDC ± 0.001 V. • ± 0.03 liter/min. Allowable difference between low- and high-level set points and operational set point (i.e., 0.5, 4.5 and 3.0 liters/min, respectively) for testing Main Flow MFC board and corresponding reference flow readings. • ± 2.0 liters/min. Allowable difference between low- and high-level set points and operational set point (i.e., 2.0, 18.0 and 13.67 liters/min, respectively) for testing Auxiliary Flow MFC board and corresponding reference flow readings.
	Amplifier Board Calibration	Annual	• Check and adjust (if applicable) test points as specified in Manual.

a - Calibration required on a semi-annual basis unless one or both acceptance criteria for quarterly Flow Audit are exceeded.
b - Calibration required on an annual basis unless one or both acceptance criteria for quarterly Flow Audit or criterion for semi-annual Flow Controller Software Calibration is exceeded.

TABLE A-2: PERIODIC QA CHECKS AND ACCEPTANCE CRITERIA

Instrument	QA Check	Frequency	Acceptance Criteria [a]
CO Analyzers	Leak Test	Semi-Annual	• No leaks detected at tube fittings or other critical locations in flow system (e.g., calibration gas delivery system, zero air generator, dilution calibrator).
	System Bias (Sample Line Integrity) Check	Semi-Annual	• ≤ 5.0%. Allowable percent difference between system response and analyzer response relative to analyzer response.
	Multi-Point Audit Response	Semi-Annual	• ≤ 5 ppm. Allowable difference between analyzer response and zero air reference gas. Applies only to zero test point. • ≤ 10.0%. Allowable average of percent differences between all four non-zero audit test points (i.e., low-low, low, mid, and high-level) and corresponding reference gas concentrations.
PM_{10} Monitors	Leak Test	Semi-Annual	• < 0.15 liter/min. Confirm that Main Flow and Total Flow (Main + Auxiliary) readings are within tolerance.
	Flow Audit	Semi-Annual	• ± 1.0 liter/min. Allowable difference between Total Flow (Main + Auxiliary) set point and reference flow reading. • ± 0.2 liter/min. Allowable difference between Main Flow set point and reference flow reading.

Zero drift is simply determined by the CO analyzer's response to the zero air reference gas which should contain less than 0.1 ppm concentration of CO. The percent calibration drift for the span test point will be determined based on the following equation:

$$\text{Span Calibration Drift} = \frac{(\text{Analyzer Response} - \text{Reference Conc})}{\text{Reference Conc}} x\,100 \qquad \text{[Eq. A-1]}$$

where:

Analyzer Response = CO monitor response to span gas concentration with calibration gas injected at end of probe and traveling through as much of sample line as practicable, including filters, scrubbers, etc.

Reference Conc = Gas dilution calibrator system-produced reference concentration (nominally 120-135 ppm)

A multi-point calibration is required when either the zero or span difference exceeds the respective performance specification limit. The measurement data are still considered valid up to the time of the control limit. Following initial installation and certification, multi-point calibrations of CO analyzer response will be performed on a quarterly basis; but, will also be required as a means of corrective action, such as discussed above, or:

- after the repair of a malfunctioning analyzer,
- after replacement of major components or performing other preventive maintenance that may affect its calibration,
- following an interruption in operation of more than a few days, or
- prior to the removal of an analyzer from a monitoring location (if it is still functioning properly).

For multi-point calibrations, acceptable zero response is again simply determined by the CO analyzer's response to the zero air reference gas. Acceptable percent difference response for the high-level test point (i.e., nominally in the range of 100-135 ppm) is determined using the basic form of Equation A-1. Similarly, acceptable percent difference response for the three intermediate test points – that is, low-low (i.e., nominally 5–10 ppm), low (i.e., nominally 20–30 ppm) and mid (i.e., 45–75 ppm) – is based on the average of the three percent difference responses determined individually using the basic form of Equation A-1.

The results of semi-annual multi-point audit response checks will not be used to satisfy the periodic multi-point calibration requirement.

Re-certification of a CO measurement system according to the initial certification criteria will be required if a sample intake system at a given location is either relocated or replaced. If a monitor or mulit-gas calibration system is replaced, a multi-point calibration will be performed.

For the gas dilution calibrator system flow verification checks of the zero (dilution) air and calibration gas MFCs, the allowable percent difference between the expected flow for a given set point and the flow rate measured by the reference flow device will be determined based on the following equation:

$$\Delta\% = \frac{(\text{Target Flow @ Flow Set Point} - \text{Reference Flow Rate})}{\text{Reference Flow Rate}} x\,100 \qquad \text{[Eq. A-2]}$$

QC check results will be included in the periodic monitoring data reports to be submitted to Mass DEP on a monthly basis (during the first year of full operations only) and a quarterly basis thereafter. Daily zero/span response check results will appear in each such report. The results of other QC checks performed at quarterly, semi-annual and/or annual intervals (as indicated in Table A-1) will also be incorporated in those reports if conducted during a given reporting period. At a minimum, this information will include:

- an identification of the monitoring sites where the QC checks were performed,
- an identification of the specific CO analyzers, gas dilution calibrators, or PM_{10} monitor components that were tested (i.e., manufacturer, model and serial number),
- a summary of the QC check results, conclusions, and recommendations,
- corrective actions taken (if any), and
- supporting appendices (i.e., DAHS printouts of test data, field data sheets, supporting calculations, Certificates of Analysis for reference gases, and Certificates of Calibration for other test equipment).

PERIODIC QUALITY ASSURANCE CHECKS

QA Performance Audits will be conducted semi-annually on all CO and PM_{10} analyzers by an organization (e.g., a subcontractor) that is independent of the personnel responsible for the routine operation, maintenance and calibration of the CEMS and related components using equipment, materials and other test devices that are not part of MTA inventory.

The primary purpose of these periodic audits is to assess CO analyzer and PM_{10} monitoring system component response to support a conclusion that instrument performance is acceptable and that valid measurement results are likely being generated. This is in concert with the periodic calibration or adjustment of such equipment based on similar, as well as additional, response checks which is a QC function addressed in the preceding subsection. Table A-2 lists the scope of such QA audit checks for each type of instrument and the corresponding acceptance criteria.

QA Performance audits may also be conducted by third-party regulatory agencies (e.g., Mass DEP).

The typical protocol for conducting Performance Audits includes coordination between the Lead Auditor and representatives of key MTA personnel (i.e., the Senior Environmental Engineer and QA Management), or their designees, before the audit to:

- schedule the activities,
- identify the specific sites to be visited,
- confirm the checks to be performed, and
- address safety- and security-related logistical concerns with the Operations Control Center (e.g., the transport of compressed gas cylinders to the monitoring locations, site access).

MTA personnel, as assigned by the Senior Environmental Engineer (i.e., the Environmental Engineer and/or Environmental Technicians), will accompany the auditing team during equipment mobilization and de-mobilization, and during performance of audit activities to provide any necessary support and to observe the tests. If any of the QA check results are determined to be out of tolerance, Table A-2 summarizes the corresponding corrective actions (including data invalidation, if appropriate) to be taken by MTA personnel to return the out-of-control system or component back to a status of compliance.

A post-audit meeting (formal or informal) between the Lead Auditor and key MTA personnel, or their designees, should take place to discuss the preliminary test results, any findings made, corrective actions completed or yet to be implemented, and any other recommendations to be considered.

A report summarizing the Performance Audit will be prepared by the auditing organization and submitted to the Senior Environmental Engineer and QA Management for review and comment. At a minimum, the Performance Audit Report shall include:

- an introduction,
- an identification of the monitoring site(s) where the audit was performed,
- an identification of the specific analyzers or components that were tested (i.e., manufacturer, model and serial number) and a description of those instruments,
- audit check results,
- conclusions, findings and/or recommendations, and
- supporting appendices (i.e., test data, field data sheets, supporting calculations, Certificates of Analysis or Calibration for test equipment and materials).

If necessary, plans and a schedule for the resolution of any audit findings or documentation of any corrective actions already taken will be prepared by the Senior Environmental Engineer and QA Management. Implementation of such plans will be coordinated between the Senior Environmental Engineer, QA Management and the auditing organization, and, as necessary, any subcontractors or equipment vendors. QA Management will ensure that the necessary corrective actions are taken and that close-out of the issue(s) is documented in a timely manner.

CALIBRATION AND AUDIT GASES AND OTHER TEST EQUIPMENT

Each CEMS at each monitoring location where CO concentration measurements are made has a dedicated compressed gas cylinder of RATA Class Certified CO gas which is used for daily upscale (span) calibration response checks, periodic multi-point calibrations, and other QC response checks. The nominal concentrations of these reference gases are as follows:

- 1,350 ppm CO, balance N2 (at locations where CAT100 CO analyzers are installed – that is, Ventilation Buildings 1, 3, 4 and 5, and longitudinally-ventilated exit ramps), and
- 7,500 ppm CO, balance N2 (at locations where Thermo Environmental Model 48C CO analyzers are installed – that is, Ventilation Buildings 6 and 7).

Likewise, zero air (i.e., air free of contaminants; O_3; NO, NO_x and SO_2 less than 0.001 ppm; and CO and Hydrocarbons less than 0.1 ppm) for daily zero calibration response checks, zero response and dilution air for intermediate upscale multi-point calibration test points, and other QC response or flow control checks is supplied by the following zero air generators:

- Teledyne-API Model 701 Zero Air Module (at Ventilation Buildings 1, 3, 4 and 5, and longitudinally-ventilated exit ramps), and
- Thermo Environmental Model 111 Zero Air Generator (at Ventilation Buildings 6 and 7).

Certificates of Analysis are affixed to each CO reference gas cylinder by the manufacturer. A copy of each certificate shall be also retained by the Senior Environmental AQ Engineer.

Auditor-supplied CO reference gases used in conducting independent or third-party Performance Audits of the CO analyzers shall also be RATA Class certified. Certificates of Analysis for both CO and zero air reference gases shall be appended to the corresponding Performance Audit test reports.

Similarly, a current certificate of calibration, establishing the traceability of a reference device to a National Institute of Standards and Technology (NIST) standard or equivalent, shall be readily available for all test equipment used in the performance of QC checks or independent Performance Audits. Such test devices may include:

- reference flow meters (e.g., volumetric dry gas meter, bubble meter, mass flow meter),
- digital voltmeters and multi-meters,
- oscilloscopes,
- thermometers,
- barometer or pressure sensors, and
- manometers.

Certificates of calibration shall be verified to be current by the Senior Environmental AQ Engineer, Environmental Field Engineer or Environmental Field Technicians before being used to perform a QC check. The original certificates shall be filed at the location where the device is stored.

Certificates of calibration for all reference test devices used in conducting independent or third-party Performance Audits of the CO and PM_{10} CEMS and related components shall be appended to the corresponding Performance Audit test reports.

QUALITY ASSURANCE SYSTEMS AUDITS

A QA Systems Audit will be performed annually by an independent organization (e.g., a subcontractor). The purpose will be to assess MTA's implementation of the continuous air emissions monitoring program for the CA/T Project in accordance with SOPs.

The scope of such audits typically comprises an appraisal of the following program areas – network management, field operations, quality control and quality assurance, data management, and reporting. Topics evaluated under these program areas may include:

- **Network Management**
  - organization and staffing,
  - adequacy of technical background and training of key personnel,
  - availability and revision status of CAEMP and SOPs,
  - network design and siting of monitoring locations,
  - current operating status of monitoring network,
  - adequacy of facilities and equipment, and proposed modifications, and
  - status of service contracts for major equipment and technical support (if applicable);
- **Field Operations**
  - general housekeeping and environmental conditions at monitoring locations,
  - operating status and condition of monitoring equipment and related systems,
  - conformance to and adequacy of CAEMP and SOPs,
  - frequency and timeliness of preventive maintenance activities,
  - inventory of spare parts, consumable items and tools, and
  - adequacy, availability and up-to-date record keeping;
- **QA/QC**
  - frequency and timeliness of QC checks - zero/span response, multi-point calibrations, flow rate verifications and calibrations,
  - traceability of calibration gases and other reference standards used for QC checks,
  - documentation of independent QA Performance Audit procedures,

- frequency and timeliness of independent QA Performance Audits (e.g., multi-point audit response and bias checks of the CO analyzers, verification of PM_{10} analyzer flow rate and mass transducer calibration constant),
- integrity of audit devices and traceability of audit reference standards, and
- documentation, implementation, and close-out of corrective action items;

- **Data Management**
  - data flow from generation in the field through processing and reporting,
  - data acquisition and handling system operation,
  - system back-up and data recovery capabilities,
  - user documentation and configuration control of DAHS and other processing software,
  - frequency and timeliness of reviews of CEMS data and QC check results,
  - data screening, flagging and validation,
  - data correction procedures and personnel authorized to make such revisions,
  - processing of CO measurements to calculate NO_x concentrations, and
  - compliance with data completeness (recovery) objectives;

- **Reporting**
  - review and approval process for periodic reports of CEMS data, excess emissions (if any), and QC check results,
  - review and approval process for periodic reports of QA Performance Audit results,
  - completeness of periodic reports and related documentation, and conformance with regulatory reporting requirements, and
  - timeliness of monitoring data, QA Performance and Systems Audit report submittals.

The typical protocol for Systems Audits includes: either a pre-audit meeting between the Lead Auditor and representatives of key management personnel (e.g., the Senior Environmental Engineer, QA Management, Director of Environmental Engineering), or their designees, and/or the submittal of a questionnaire or audit form identifying the specific items to be covered; onsite observations and interviews with key operational and management personnel (as appropriate); followed by a post-audit close-out meeting between the Lead Auditor and key project management personnel, or their designees.

At the completion of a Systems Audit, the results are expected: to support conclusions about the overall operation of the continuous air emissions monitoring program for the CA/T Project; to provide an indication of the adequacy of the CEM Air Emissions Monitoring Protocol and SOPs and how well they are being implemented; to identify any deficiencies; and to make recommendations for their resolution and other opportunities for improvement.

A report summarizing the Systems Audit results will be prepared by the auditing organization and submitted to the Senior Environmental Engineer and QA Management for review and comment. If necessary, plans and a schedule for the resolution of any audit findings will be prepared by these individuals. Implementation of such plans will be coordinated between the Senior Environmental Engineer, QA Management and the auditing organization, and, as necessary, any subcontractors or equipment vendors. QA Management will ensure that the necessary corrective actions are taken and that close-out of the issue(s) is documented in a timely manner.

THIRD-PARTY AUDITS

At any time during the continuous air emissions monitoring program for the CA/T Project, the Mass DEP may conduct independent Performance Audits of the CO and PM_{10} CEMS and related components at any location in the monitoring network. Mass DEP may also conduct independent Systems Audits to evaluate

the effectiveness of MTA's execution of the CEM Air Emissions Monitoring Protocol and implementation of the associated SOPs.

The auditing agency is expected to provide its own test equipment and certified gas standards for conducting such audits. In the case of Performance Audits of CO analyzer response, zero air and RATA Class certified upscale reference gases shall be provided by Mass DEP as well.

In order to effectively allocate personnel and other resources, and to coordinate safety- and security-related logistical concerns with the Operations Control Center (e.g., the transport of compressed gas cylinders to the monitoring location, site access), MTA will require at least two weeks notice prior to scheduling any audit. The Senior Environmental Engineer, or designee (e.g., QA Management), shall be the point of contact for coordinating all such third-party audit requests. This provision applies to performance audits or systems audits and does not preclude immediate access during an air pollution incident emergency.

A pre- and post-audit meeting protocol should be followed with appropriate key personnel from each organization attending. As appropriate to the type of audit, MTA personnel responsible for the operation, maintenance and calibration of the CEMS and related equipment, and/or for the processing, validation and reporting of the measurement results, will accompany the agency's auditor(s) during all such activities.

A Performance and/or Systems Audit Report should be prepared by Mass DEP and distributed to MTA's Senior Environmental Engineer and QA Management for the monitoring program for their review and comment. As with other independent audits, plans and a schedule for the resolution of any audit findings will be prepared by these individuals. Implementation of such plans will be coordinated between the Senior Environmental Engineer, QA Management and Mass DEP, and, as necessary, any subcontractors or equipment vendors. QA Management will ensure that the necessary corrective actions are taken and that close-out of the issue(s) is documented in a timely manner